

What is claimed is:

1 1. A device for transmitting and receiving signals over a  
2 communications line, comprising:

3 a transmitter circuit having an output coupled to the  
4 communications line;

5 a receiver circuit having an input coupled to the  
6 communications line; and

7 a hybrid circuit connected to the transmitter output, the  
8 receiver input and the communications line, for filtering  
9 signals at frequencies that fall outside of a predetermined  
10 frequency range, the hybrid circuit being configured as a  
11 voltage divider formed from reactive elements for substantially  
12 canceling signals transmitted by the transmitter circuit from  
13 appearing at the receiver input.

1 2. The device of claim 1, wherein:

2 the hybrid circuit comprises a first order filter.

1 3. The device of claim 1, wherein:

2 the hybrid circuit comprises a high pass filter.

1 4. The device of claim 1, wherein:

2 the hybrid circuit is configured as a capacitive divider  
3 for scaling the signals at the transmitter output for  
4 cancellation with related signals appearing on the  
5 communications line.

1 5. The device of claim 4, wherein the hybrid circuit  
2 comprises:

3 a first capacitor having a first terminal connected to the  
4 communications line and a second terminal;

5 a second capacitor having a first terminal connected to the  
6 transmitter output and a second terminal connected to the second  
7 terminal of the first capacitor; and

8 a resistor having a first terminal connected to the second  
9 terminal of the first capacitor and a second terminal connected  
10 to a reference voltage.

1 6. The device of claim 5, wherein:

2 the ratio between the capacitance of the first capacitor to  
3 the capacitance of the second capacitor is substantially the  
4 same as the ratio between the voltage level at the transmitter  
5 output to the voltage level of a related signal appearing on the  
6 communications line.

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1           7. The device of claim 1, wherein:  
2           the communications line comprises a differential pair of  
3           communications lines;  
4           the transmitter output is a differential output;  
5           the receiver input is a differential input; and  
6           the hybrid circuit comprises a first filter circuit having  
7           a first terminal connected to a first line of the differential  
8           pair of communications lines, a second terminal connected to a  
9           first line of the differential output of the transmitter and a  
10          third terminal connected to a first line of the differential  
11          input of the receiver, the first filter circuit being configured  
12          as a voltage divider formed from reactive elements for  
13          substantially canceling signals transmitted by the transmitter  
14          and appearing on the first terminal of the differential output  
15          thereof from appearing at the first line of the differential  
16          input of the receiver.

1 8. The device of claim 7, wherein:

2 the hybrid circuit further comprises a second filter  
3 circuit having a first terminal connected to a second line of  
4 the differential pair of communications lines, a second terminal  
5 connected to a second line of the differential output of the  
6 transmitter and a third terminal connected to a second line of  
7 the differential input of the receiver, the second filter  
8 circuit being configured as a voltage divider formed from  
9 reactive elements for substantially canceling signals  
10 transmitted by the transmitter and appearing on the second  
11 terminal of the differential output thereof from appearing at  
12 the second line of the differential input of the receiver.

1 9. The device of claim 8, wherein:

2 the second filter circuit forms a capacitive divider.

1 10. The device of claim 8, wherein:

2 the second filter circuit comprises a pair of series  
3 connected capacitors connected between the second line of the  
4 differential pair of communications lines and the second line of  
5 the differential output of the transmitter, and a resistor  
6 having a first terminal connected to each of the capacitors and  
7 a second terminal connected to a reference voltage.

A 1 11. The device of claim 8, wherein:  
2 the second filter circuit comprises a first order, high  
3 pass filter.

1 12. The device of claim 8, wherein:  
2 the first filter circuit and the second filter circuit each  
3 comprise a first order high pass filter.

1 13. The device of claim 7, wherein:  
2 the first filter circuit forms a capacitive divider.

1 14. The device of claim 7, wherein:  
2 the first filter circuit comprises a pair of series  
3 connected capacitors connected between the first line of the  
4 differential pair of communications lines and the second line of  
5 the differential output of the transmitter, and a resistor  
6 having a first terminal connected to each of the capacitors and  
7 a second terminal connected to a reference voltage.

1 15. The device of claim 7, wherein:  
2 the hybrid circuit further comprises an amplifier circuit  
3 configured as an inverting amplifier that is connected between  
4 the transmitter output and the first filter circuit, the  
5 amplifier circuit and the first filter circuit generating a  
6 first scaled output voltage signal and a second scaled voltage  
7 signal which cancel each other at the receiver input.

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1 16. A hybrid circuit associated with an end of a  
2 telecommunications line to which a transmitter and a receiver  
3 are connected, comprising:

4 a first circuit having a first terminal coupled to an  
5 output of the transmitter, a second terminal coupled to an input  
6 of the receiver and a third terminal coupled to the  
7 telecommunications line, for canceling signals transmitted by  
8 the transmitter from appearing at the receiver input and  
9 filtering signals at predetermined frequencies on the  
10 telecommunications line from appearing at the receiver input so  
11 that the receiver is substantially isolated from the  
12 transmitter, the first circuit forming a voltage divider of  
13 reactive elements that is configured as a filter.

1 17. The hybrid circuit of claim 16, wherein:  
2 the first circuit comprises a high pass filter.

1 18. The hybrid circuit of claim 16, wherein:  
2 the first circuit capacitively scales signals appearing at  
3 the output of the transmitter and on the telecommunications line  
4 so as to substantially cancel common signals therebetween.

1 19. The hybrid circuit of claim 18, wherein:  
2 the first circuit is configured as a high pass filter.

1 20. The hybrid circuit of claim 18, wherein the first  
2 circuit comprises:

3 a first capacitor having a first terminal connected to the  
4 telecommunications line and a second terminal;

5 a second capacitor having a first terminal connected to the  
6 transmitter output and a second terminal connected to the second  
7 terminal of the first capacitor; and

8 a resistor connected between to the second terminal of the  
9 first capacitor and a reference voltage.

1 21. The hybrid circuit of claim 20, wherein:

2 the ratio between the capacitance value of the first  
3 capacitor to the capacitance value of the second capacitor is  
4 substantially the same as the voltage swing of signals at the  
5 transmitter output to the voltage swing of related signals  
6 appearing on the telecommunications line.



1 22. The hybrid circuit of claim 17, further comprising:  
2 a second circuit configured as an inverting amplifier, the  
3 second circuit connected between the transmitter output and an  
4 input of the first circuit.

1 23. The hybrid circuit of claim 16, wherein:  
2 the transmitter output is a differential output;  
3 the receiver input is a differential input;  
4 the telecommunications line is a two-wire line;  
5 the first terminal of the first circuit is connected to a  
6 first output line of the transmitter output, the second terminal  
7 of the first circuit is connected to a first input line of the  
8 receiver, and the third terminal of the first circuit is  
9 connected to a first line of the telecommunications line; and  
10 the hybrid circuit further comprises a second circuit  
11 having a first terminal connected to a second output line of the  
12 transmitter output, a second terminal connected to a second  
13 input line of the receiver, and a third terminal connected to a  
14 second line of the telecommunications line, for canceling  
15 signals relating to signals generated by the transmitter and  
16 appearing at the second input line of the receiver, and for  
17 filtering signals on the second telecommunications line at  
18 predetermined frequencies from appearing at the second input

19 line of the receiver, the second circuit forming a voltage  
20 divider of reactive elements that is configured as a filter.

1 24. The hybrid circuit of claim 23, wherein:  
2 the second circuit capacitively scales signals appearing at  
3 the second output line of the transmitter and signals appearing  
4 on the second telecommunications line so that common signals  
5 therebetween cancel at the second input of the receiver.

1        25. A hybrid circuit associated with an end of a  
2        telecommunications line to which a transmitter and a receiver  
3        are connected, comprising:

4            a first filter circuit connected to an output of the  
5        transmitter, the telecommunications line and an input of the  
6        receiver, for filtering signals at predetermined frequencies  
7        appearing on the transmitter output and the telecommunications  
8        line, scaling signals appearing on the transmitter output, and  
9        canceling the scaled signals at the receiver input with related  
10       signals appearing on the telecommunications line.

1            26. The hybrid circuit of claim 25, wherein:

2            the first filter circuit includes a first reactive  
3        component connected between the telecommunications line and the  
4        receiver input, a first electrical component connected between  
5        the transmitter output and the receiver input, and a second  
6        electrical component connected between the receiver input and a  
7        reference voltage.

1            27. The hybrid circuit of claim 25, wherein:

2            the first filter circuit is configured as a capacitive  
3        divider.

1 28. The hybrid circuit of claim 27, wherein:  
2 the first filter circuit forms a high pass filter.

1 29. The hybrid circuit of claim 27, wherein:  
2 the first filter circuit includes a first capacitor  
3 connected to the transmitter output, a second capacitor  
4 connected to the telecommunications line and a resistor  
5 connected to the first and second capacitors.

1 30. The hybrid circuit of claim 29, wherein:  
2 the ratio of the capacitance value of the first capacitor  
3 to the capacitance value of the second capacitor is  
4 substantially the same as the voltage swing of the signals  
5 appearing on the transmitter output to the voltage swing of the  
6 related signals appearing on the telecommunications line.

1 31. The hybrid circuit of claim 25, wherein:  
2 the first filter circuit forms a low pass filter.

*add A17*